

# **YELLOWSTONE RESOURCES & ISSUES**

# **2006**

*Division of  
Interpretation*

•

*Yellowstone  
National Park*

***The National Park Service and Yellowstone National Park wish to thank the Yellowstone Association, which funded this full color edition.***

## **Contributors**

Production of Yellowstone Resources and Issues 2006 is made possible through the efforts of many people in Yellowstone National Park and beyond. These include:

Karen Angermeier  
Lane Baker and staff  
Tami Blackford  
Tom Cawley  
Diane Chalfant  
Clare Cloghessy  
Jennifer Conrad  
Katy Duffy and staff  
Judy Knuth Folts  
Bob Fuhrmann and staff  
Deb Guernsey  
Henry Heasler  
Judy Jensen and staff  
Craig Johnson  
Beth Kaeding  
Steve Miller  
Peggy Olliff  
Jim Peaco

Roy Renkin  
Ann Rodman & staff  
Jo Suderman  
Brian Suderman and staff  
Virginia Warner  
Tammy Wert and staff

Dr. Lisa Morgan, U.S. Geological Survey  
Dr. Toni K. Ruth, Wildlife Conservation Society

The Yellowstone National Park staff experts who contributed updates to this edition are listed at the end of each chapter in “For More Information.”

### **Editing, design, production:**

Carolyn Duckworth, Publications Program Manager, Division of Interpretation

**Managing Editor:** Linda Young, Deputy Chief of Interpretation: Planning and Media

*Produced by the Division of Interpretation, Yellowstone National Park, Mammoth Hot Springs, Wyoming.  
All material is in the public domain unless noted below.*

*Front cover: NPS/Austin & Jones*

*Most photographs from Yellowstone National Park collection. Individuals or organizations contributing photos: title page—CTA Associates; p. 35, 53 (3), 54, 55 (top), 57 (bottom), 60, 63, 66, 80, 81, 151, 171, 179, 187, 190 (bottom), 199—Carolyn Duckworth; p. 43—UWS/UWM Great Lakes Water Institute; p. 44—Dr. Russell Cuhel; p. 49—Robert Smith; p. 53 (bottom), 56 (bottom), 58 (left top & center)—Thermal Biology Institute, Montana State University; p. 57 (2nd from bottom), 68—Jennifer Whipple; p. 98, 141—Tom Cawley; p. 102—Toni K. Ruth, Hornocker Wildlife Institute & Wildlife Conservation Society; p. 144, top left—Eric Engbretson, USFWS; p. 144, middle left—David Riecks, University of Illinois at Urbana-Champaign; p. 144, bottom left—Charles Ramcharan, Wisconsin Sea Grant; p. 144, right—Florida Department of Agriculture & Consumer Services; p. 146—Thomas Brock; p. 157—Michael S. Sample.*

*Most maps and illustrations produced by the staff of Yellowstone National Park, including the Spatial Analysis Center, or are from other National Park Service sources. Exceptions: p. 7—Dan Chapman; wildlife illustrations on page 16 and Chapter 7—© Zachary Zdinak; p. 21—adapted from map first appearing in Yellowstone Science, Fall 2001; p. 37, 38, 39, 40, 46—courtesy Robert Smith, from Windows Into the Earth (co-authored with Lee J. Siegel), 2000, Oxford Press; p. 43–44, Dr. Lisa Morgan, U.S. Geological Survey; p. 52—Dr. Jack Farmer, first appearing in GSA Today, July 2000; p. 55 (bottom)—Thermal Biology Institute, Montana State University; p. 125—Debra Patla; p. 163—CTA Architects & Engineers*

<b>Introduction.....</b>	<b>7</b>	<b>3 Geology.....</b>	<b>37</b>
The Beginning of an Idea . . . . .	7	What Lies Beneath . . . . .	37
Today's National Park System . . . . .	8	Ancient Yellowstone . . . . .	38
NPS Mission Statement . . . . .	9	Magma & Hotspots . . . . .	38
YNP Mission Statement . . . . .	10	Future Volcanic Activity . . . . .	40
Significance of YNP . . . . .	10	Geyser Basin Systems . . . . .	41
Park Facts . . . . .	11	Hydrothermal Features . . . . .	42
Frequently Asked Questions . . . . .	12	Beneath Yellowstone Lake . . . . .	43
<b>1 History of the Park.....</b>	<b>19</b>	Earthquakes . . . . .	45
Earliest Humans in Yellowstone . . . . .	19	Glaciers . . . . .	46
Increased Use . . . . .	20	Sedimentation & Erosion . . . . .	47
The Little Ice Age . . . . .	22	Fossils . . . . .	48
Historic Tribes . . . . .	22	Research . . . . .	49
"Sheep Eaters" . . . . .	22	Yellowstone Volcanic Observatory . . . . .	49
European Americans Arrive . . . . .	23	<b>4 Life in Extreme Heat.....</b>	<b>51</b>
Expeditions . . . . .	23	About Microbes . . . . .	52
Birth of a National Park . . . . .	24	Thermophiles in the Tree of Life . . . . .	52
The Formative Years . . . . .	25	Thermophilic Bacteria . . . . .	53
The Army Arrives . . . . .	26	Thermophilic Archaea . . . . .	54
The National Park Service Begins . . . . .	27	Thermophilic Viruses . . . . .	55
Boundary Adjustments . . . . .	28	Thermophilic Eukarya . . . . .	56
The 1940s . . . . .	28	Thermophilic Communities . . . . .	58
Mission 66 . . . . .	28	Thermophiles by Place and Color . . . . .	60
From Managed to "Natural" . . . . .	29	Thermophiles in Time & Space . . . . .	61
Complex Times . . . . .	29	<b>5 Vegetation.....</b>	<b>63</b>
The Legacy of Yellowstone . . . . .	30	Major Types . . . . .	63
<b>2 Greater Yellowstone Ecosystem.....</b>	<b>31</b>	Effects of Disturbances . . . . .	65
Biological Diversity . . . . .	33	Trees . . . . .	66
Cycles & Processes . . . . .	33	Endemics . . . . .	68
Community Complexity . . . . .	34	Exotics . . . . .	69
Winter . . . . .	35	<i>contents continue . . . . .</i>	
Management Challenges . . . . .	36		

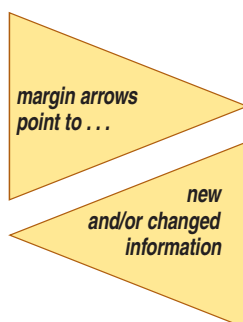
<b>6</b>	<b>Fire .....</b>	<b>71</b>	<b>9</b>	<b>Park Issues .....</b>	<b>141</b>
	Fire Ecology .....	71		Aquatic Invaders .....	141
	Fire Management .....	72		Bioprospecting .....	145
	The Fires of 1988 .....	75		Bison Management .....	148
	Results of Research .....	79		Grizzly & Black Bear Management .....	153
				Northern Range .....	158
<b>7</b>	<b>Wildlife .....</b>	<b>83</b>		Sustainable Practices .....	161
<b>A.</b>	<b><i>Mammals</i></b>			Wilderness .....	165
	List of Mammals in Yellowstone ....	83		Winter Use .....	167
	Small Mammals .....	86		Wolf Restoration .....	174
	Bear, Black .....	93	<b>10</b>	<b>Major Areas of the Park .....</b>	<b>179</b>
	Bear, Grizzly .....	94		Canyon .....	179
	Bears, Comparison .....	95		Lake & Fishing Bridge .....	182
	Beaver .....	96		Madison/West Entrance .....	185
	Bighorn Sheep .....	97		Mammoth Hot Springs .....	187
	Bison .....	98		Norris .....	190
	Cats: Bobcat & Lynx .....	100		Old Faithful .....	193
	Cougar .....	101		Tower–Roosevelt .....	196
	Coyote .....	103		West Thumb & Grant .....	198
	Deer, Mule & White-tailed .....	104			
	Elk .....	105			
	Fox .....	107			
	Moose .....	109			
	Pronghorn .....	111			
	Wolf .....	113			
	<b><i>B: Birds</i> .....</b>	<b>115</b>			
	<b><i>C: Fish</i> .....</b>	<b>121</b>			
	<b><i>D: Reptiles &amp; Amphibians</i> .....</b>	<b>125</b>			
<b>8</b>	<b>Cultural Resources .....</b>	<b>133</b>			
	Archeology .....	133			
	Cultural Landscapes .....	134			
	Ethnography .....	134			
	Associated Tribes .....	134			
	By Word of Mouth .....	135			
	Historic Structures & Districts ....	136			
	Collections .....	139			
	Cultural Resource Laws .....	139			

In this book, you will find concise information about the park's history, natural resources, cultural resources, issues, and major areas. This material was provided and reviewed by park researchers, resource specialists, and staffs of Planning, Public Affairs, and Interpretation.

## Organization of Chapters:

- Summary box containing key facts
- Main text providing overview of subject
- Resource list for more information

Some material is repeated in the book to accommodate users with varying needs.



## New/revised in 2006:

Ch. 4 revised

Ch. 9 bioprospecting & winter use revised

## Updating the Information

Information about Yellowstone constantly changes; the information provided here is current as of March 2006. You can find updates and comprehensive information on the park website ([www.nps.gov/yell](http://www.nps.gov/yell)), in park publications and exhibits, or by asking the park's interpretive rangers who staff the visitor centers.

We welcome your feedback and comments.

